PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

TAKAGUCHI et al

Application No.: 10/573,449 Art Unit: 1793

Filing date: January 19, 2007 Examiner: Megha Mehta

For: WAVE SOLDERING TANK

PETITION UNDER 37 CFR 1.181 TO WITHDRAW HOLDING OF ABANDONMENT

Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In accordance with 37 CFR 1.181(a), the Applicants petition to the Director of the USPTO to withdraw the holding of abandonment in connection with the present application. No fee is required for this petition.

A Notice of Abandonment of the present application was mailed on March 31, 2011. According to the Notice, the application had gone abandoned for failure to reply to the Official Action of September 22, 2010.

In fact, a response to the Official Action of September 22, 2010 was filed on February 22, 2011. The response was accompanied by a Request for Continued Examination, the RCE fee set forth in 37 CFR 1.17(e), and the fee for a two-month extension of time. The response, which was submitted to the PTO by facsimile, included a Certificate of Transmission. An Auto-Reply Facsimile Transmission from the PTO indicated that the response was received by the PTO on February 22, 2011 at 4:42 PM Eastern Standard Time.

A copy of the Auto-Reply Facsimile Transmission is attached to this petition as Attachment A, and a complete copy of the response filed on February 22, 2011 is attached to this petition as Attachment B.

In light of the attached evidence that a response to the Official Action of September 22, 2010 was filed in a timely manner, the holding of abandonment of the present application is improper and should be withdrawn.

The PAIR system indicates that a declaration under 37 CFR 1.132 was filed in connection with this application on February 27, 2011. The transmittal letter accompanying that declaration referred to the response filed on February 22, 2011, making it clear that a response had been already filed. The attention of the Examiner is directed to the declaration filed on February 27, 2011 so that it will be considered by the Examiner in conjunction

with the response filed on February 22, 2011.

Respectfully submitted,

Michael Tobias
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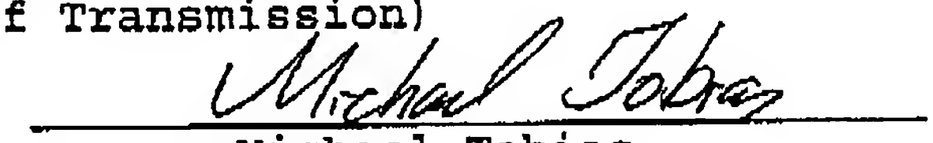
Facsimile: (301) 571-0069
Date: April 4, 2011

Attachments
Attachment A: copy of Auto-Reply Facsimile Transmission received on February 22, 2011

Attachment B: copy of response filed on February 22, 2011

Certificate of Transmission

I hereby certify that this correspondence is being facsimile transmitted to the Patent and Trademark Office
on April 4, 2011
(Date of Transmission)

Signature 
Michael Tobias

ATTACHMENT A

Copy of Auto-Reply Facsimile Transmission

received on February 22, 2011

Application No. 10/573,449

Auto-Reply Facsimile Transmission

TO: Fax Sender at 3015710069

Fax Information
Date Received: 2/22/2011 4:42 PM [Eastern Standard Time]
Total Pages: 35 (including cover page)

ADVISORY: This is an automatically generated return receipt confirmation of the facsimile transmission received by the Office. Please check to make sure that the number of pages listed as received in Total Pages above matches what was intended to be sent. Applicants are advised to retain this receipt in the unlikely event that proof of this facsimile transmission is necessary. Applicants are also advised to use the certificate of facsimile transmission procedures set forth in 37 CFR 1.8(a) and (b), 37 CFR 1.6(f). Trademark Applicants, also see the Trademark Manual of Examining Procedure (TMEP) section 306 et seq.

Received
Cover
Page
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02/22/2011 16:48 3015710069 TOBIAS 40365 P.001/035

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:
TAKAGUCHI et al
Application No.: 10/573,449 Art Unit: 1793
Filing date: January 19, 2007 Examiner: Megha Mehta
For: WAVE SOLDERING TANK

FAX COVER LETTER

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
Fax: (571) 273-8300

The following materials are being transmitted by facsimile to the United States Patent and Trademark Office on February 22, 2011 in connection with the above-identified application:

Fax cover letter	1 page
RCE transmittal letter	3 pages
Credit card payment form PTO-2038	1 page
Amendment	22 pages
Declaration under 37 CFR 1.132 with Exhibits	8 pages
TOTAL	35 PAGES

Respectfully submitted,

Michael Tobias

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Date: February 22, 2011
1082

PAGE 1/35 * RCVD AT 2/22/2011 4:42:58 PM [Eastern Standard Time] * SVR:W-PTOFAX-003/9 * DNIS:2738300 * CSID:3015710069 * DURATION (mm-ss):07-42

ATTACHMENT B

Copy of response filed on February 22, 2011

Application No. 10/573,449

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:
TAKAGUCHI et al
Application No.: 10/573,449 Art Unit: 1793
Filing date: January 19, 2007 Examiner: Megha Mehta
For: WAVE SOLDERING TANK

FAX COVER LETTER

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TOTAL	35 PAGES

Respectfully submitted,

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Date: February 22, 2011
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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

TAKAGUCHI et al

Application No.: 10/573,449 Art Unit: 1793

Filing date: January 19, 2007 Examiner: Megha Mehta

For: WAVE SOLDERING TANK

REQUEST FOR CONTINUED EXAMINATION (RCE) TRANSMITTAL

Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified patent application.

1. Submissions under 37 CFR 1.114

The following items are attached as submissions under 37 CFR 1.114

[x] amendment

[x] declaration under 37 CFR 1.132

2. The Applicants petition for a two-month extension of time

for responding to the Official Action of September 22, 2010, extending the period for response to and including February 22, 2011 and submit the requisite fee.

3. Summary of Fees

[x]	RCE fee set forth in 37 CFR 1.17(e)	$810
[x]	Fee for a two-month extension of time	$490
[ ]	Additional claim fee	$0
	TOTAL FEES	$1300

3. Payment of Fees

[x] Payment by credit card (Form PTO-2038 attached).

[x] The Commissioner is authorized to charge any deficiency in the following fees associated with this communication and to credit any excess payment to Deposit Account No. 50-1079.

[x] Any filing fees pursuant to 37 CFR §1.16 for the presentation of extra claims.

[x] Any patent application processing fees pursuant to 37 CFR §1.17, including extension of time fees pursuant to 37 CFR §1.17(a)-(d).

Respectfully submitted,

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Date: February 22, 2011

Certificate of Transmission

I hereby certify that this correspondence is being facsimile transmitted to the Patent and Trademark Office on February 22, 2011
(Date of Transmission)

Signature 
Michael Tobias

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

TAKAGUCHI et al

Application No.: 10/573,449 Art Unit: 1793

Filing date: January 19, 2007 Examiner: Megha Mehta

For: WAVE SOLDERING TANK

AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Official Action mailed on September 22, 2010, the Applicants request that the application be amended as shown below. A petition for a two-month extension of time and the appropriate fee, extending the period for response to and including February 22, 2011, were filed as part of a Request for Continued Examination filed concurrently with this amendment.

IN THE CLAIMS:

Please amend the claims as shown below. The status of the claims after amendment will be as follows:

Claims 1 - 8 (cancelled)

9. (previously presented) A wave soldering tank comprising a soldering tank body for housing molten solder, a solder feed chamber disposed within the soldering tank body and having an inlet disposed below the level of molten solder and an outlet disposed above the level of molten solder in the soldering tank body, and a multiple-blade screw-type pump comprising an impeller having a rotatable hub and at least 4 helical blades secured to the hub disposed in the inlet so as to draw molten solder into the solder feed chamber through the inlet and discharge molten solder through the outlet.

Claim 10 (cancelled)

11. (previously presented) A wave soldering tank as claimed in claim 9, wherein each of the blades overlaps an adjoining one of the blades when the blades are viewed in the axial direction of the impeller.

12. (previously presented) A wave soldering tank as claimed in claim 11 wherein the blades are provided at equal

intervals in the circumferential direction of the hub, each blade extending around the hub by at least 120° between first and second ends of the blade.

13. (previously presented) A wave soldering tank as claimed in claim 9 wherein each of the blades is sloped by at most 45° with respect to a plane perpendicular to a rotational axis of the hub.

14. (previously presented) A wave soldering tank as claimed in claim 9 wherein the solder feed chamber comprises a partition which divides the interior of the soldering tank body into an upper and lower portion, the inlet comprises an opening formed in the partition, and the pump includes an impeller and a cylindrical casing disposed in the inlet and surrounding the impeller, the impeller being rotatably disposed in the casing so as to transport molten solder in an axial direction of the casing.

15. (previously presented) A wave soldering tank as claimed in claim 14 wherein the solder feed chamber includes a duct which extends upwards from the partition and a nozzle disposed at an upper end of the duct and extending above the surface of molten solder in the soldering tank body.

16. (previously presented) A wave soldering tank as claimed in claim 14 wherein a lower end of the impeller extends 5

- 10 mm below a lower end of the casing.

17. (previously presented) A wave soldering tank as claimed in claim 14 wherein a clearance between the casing and the impeller is 0.1 - 1 mm.

Claims 18 - 19 (cancelled)

20. (currently amended) A wave soldering tank comprising a soldering tank body for housing molten solder, a horizontal partition extending across the tank body below the level of molten solder in the tank body, the partition having first and second openings horizontally spaced from each other, a bowl-shaped guide secured to a lower side of the partition and having curved surfaces which are curved directly beneath the first and second openings for guiding fluid beneath the first and second openings, a nozzle having a lower end in fluid communication with the second opening in the partition and an upper end disposed above the level of molten solder in the tank body, and a multiple-blade screw-type pump ~~having a multiple-blade screw-type pump~~ having an impeller disposed so as to draw molten solder downwards through the first opening into a space between the partition and the bowl-shaped guide.

21. (previously presented) A wave soldering tank as claimed in claim 20 wherein the impeller is disposed in the first opening of the partition.

22. (previously presented) A wave soldering tank as claimed in claim 20 wherein the impeller includes at least four helical blades.

23. (previously presented) A wave soldering tank as claimed in claim 20 including a duct extending upwards from the partition above the second opening and communicating between the second opening and the lower end of the nozzle.

24. (currently amended) A wave soldering tank as claimed in claim 23 wherein there ~~are no obstructions to flow of fluid~~ is no flow straightening plate in the wave soldering tank between the pump and ~~and~~ an interior of the nozzle.

25. (currently amended) A wave soldering tank comprising a soldering tank body for housing molten solder, a nozzle having an upper end disposed above a level of molten solder in the tank body and a lower end, a screw-type pump having an impeller with at least 4 helical blades disposed in the tank body below the level of molten solder in the tank body, each of the blades overlapping an adjoining one of the blades when the blades are viewed in an axial direction of the impeller, and a casing surrounding the impeller and having a lower end fluidly communicating with an interior of the nozzle along ~~an unobstructed~~ a flow path extending from the casing to the interior of the nozzle with no flow straightening plate in the flow path.

26. (currently amended) A wave soldering tank as claimed in claim 20 wherein each curved surface ~~extends beneath one of the openings~~ is curved from the lower side of the partition ~~towards a bottom of the guide~~ to directly beneath one of the first and second openings.

27. (previously presented) A wave soldering tank as claimed in claim 26 wherein each of the curved surfaces comprises an end wall of the guide.

Claim 28 (cancelled)

29. (new) A wave soldering tank as claimed in claim 20 wherein the bowl-shaped guide is disposed inside the tank body between the partition and a bottom inner surface of the tank body.

REMARKS

In response to the Official Action mailed on September 22, 2010, the application has been amended. No new matter has been added. Reconsideration of the rejections of the claims is respectfully requested in view of the above amendments and the following remarks.

On page 4 of the Official Action, claims 9, 11 - 17, and 20 - 28 were rejected under 35 USC 103(a) as unpatentable over JP 62-259665 (referred to below as Kabe) in view of WO 03/048579 (referred to below as Gerstenberg). WO 03/048579 corresponds to U.S. Patent No. 7,165,933, so these remarks will refer to the U.S. version of Gerstenberg, as was done in the Official Action.

This rejection, which is essentially identical to the rejection made in the Official Action of March 16, 2010, is traversed because a person skilled in the art could not find any reason to combine the cited references in the manner proposed by the Official Action.

Kabe discloses a wave soldering apparatus having a pump 15 with a spiral screw 23 which is rotated by a motor 33 to discharge molten solder from a nozzle 18. Kabe does not teach or suggest a multiple-blade screw.

Gerstenberg discloses a screw pump for transporting

emulsions susceptible to mechanical handling. According to column 3, lines 65 - 67 of Gerstenberg, the number of blades in the screw pump is preferably in the range of 1 - 10, more preferably 1 - 6, and most preferably 2 - 5. The example shown in Figure 1 of Gerstenberg has two screw blades 11.

Column 5, lines 19 - 28 of Gerstenberg states that the screw pump is for the purpose of pumping any emulsion that is susceptible to mechanical or temperature damage and is particularly suited for pumping emulsions comprising oil or fat, water, and optionally a gas. Examples of such emulsions are dairy products, butter, margarine, margarine products, spread, mayonnaise, dressings, toppings, dough, creams, lotions, ointments, etc. Preferably the emulsion is a food.

According to page 5 of the Official Action, it would have been obvious to employ the multiple-blade screw pump of Gerstenberg with at least four helical blades in the device of Kabe "because the multiple-blade pump more efficiently and effectively transports the viscous liquid than would a single-blade pump".

As set forth at length in the amendment filed on August 16, 2010, the above-described argument made in the Official Action includes the following flaws:

(a) There is no teaching or suggestion in either Kabe or

Gerstenberg that a multiple-blade pump more efficiently and effectively transports a viscous liquid than would a single-blade pump. Gerstenberg states that a screw pump having 2 - 5 blades is preferable to a screw pump having 1 - 10 or 1 to 6 blades, but why this is or might be the case is left unsaid, and there is certainly no basis in Gerstenberg for the assertion in the Official Action that this number of blades is more efficient and effective. For all a person skilled in the art could tell from the disclosure of Gerstenberg, 2 - 5 blades might be preferable in the mind of Gerstenberg simply because the numbers 2 - 5 were Gerstenberg's favorite numbers. The statement in the Official Action that at least four helical blades increases efficiency or effectiveness is unsupported by the references.

(b) Even if the use of 2 - 5 blades in Gerstenberg increased the efficiency and effectiveness of the pump of Gerstenberg, this circumstance would not teach a person skilled in the art what number of blades would be most efficient or effective in Kabe, because Gerstenberg and Kabe handle entirely different fluids. Kabe relates to a wave soldering tank for handling molten solder, and there is nothing in Gerstenberg to suggest that the properties of a screw pump for handling emulsions are in any way applicable to a screw pump for handling molten solder. Molten solder is not an emulsion, and none of the considerations set forth in Gerstenberg with respect to an emulsion, such as the need to handle it "in a gentle way without excessive influences of heat or pressure to the product" (column

2, lines 40 - 42 of Gerstenberg) are pertinent to the handling of molten solder. Gerstenberg remains nonanalogous art with respect to Kabe, and a person skilled in the art could not find any reason to combine Kabe and Gerstenberg in the manner proposed by the Official Action. As set forth in the amendment filed on August 16, 2010, there is a huge difference in the viscosities of the substances handled in Gerstenberg (food product emulsions) and in Kabe (molten solder). Column 3, lines 19 - 22 of Gerstenberg state that the viscosity of materials to be handled by its pump is higher than 100 cp, preferably higher than 500 cp, and most preferably higher than 1000 cp. As stated in the previous amendment, molten solder is a low viscosity material. For example, a Pb-Sn solder of approximately a eutectic composition, which historically has been the most widely used type of solder for soldering of electronic parts, has a viscosity of only around 2.7 cp. To a person skilled in the art, the vast difference between the viscosity of the emulsions being handled in Gerstenberg and the viscosity of the molten solder being handled in Kabe renders the disclosure of Gerstenberg of no relevance to the disclosure of Kabe.

Concerning the fact that Gerstenberg does not give any reason why the preferred number of blades of its pump is 2 - 5, page 2 of the Official Action argued that "Why Gerstenberg wants 2 - 5 blades is not of relevance to the combination, only the fact that he does."

The Applicants disagree with this assertion. A person skilled in the art is not a chimpanzee operating on the principle of "monkey-see monkey-do". If Gerstenberg can neither explain what is the advantage of 2 - 5 blades or under what circumstances that advantage occurs, a person skilled in the art could not know whether 2 - 5 blades in fact provides any advantage or whether this advantage would have any applicability to the pump of Kabe. The reason why one piece of prior art chooses a specific arrangement is of paramount importance to a person skilled in the art in deciding whether there is a reason to employ that arrangement in a different situation, such as to modify a different piece of prior art. Since Gerstenberg is silent about why 2 - 5 blades are advantageous, a person skilled in the art could not see any reason to modify Kabe to employ this number of blades.

Concerning the fact that the pump of Gerstenberg and the pump of Kabe are intended for use with fluids having totally different viscosities, the Official Action dismisses this difference as being of utterly no significance. Specifically, page 3 of the Official Action states that "Just because Gerstenberg uses his pump for particularly viscous material does not mean that Gerstenberg's pump wouldn't be used for less viscous materials".

On the contrary, the viscosity of the fluid being handled by a particular pump is of the utmost significance to a pump

designer in determining whether one pump is relevant to another pump, and the great difference between the viscosity of the fluid being handled by the pump of Kabe and the viscosity of the fluid being handled by the pump of Gerstenberg renders the teachings of Gerstenberg, such as they are, irrelevant to Kabe. Gerstenberg acknowledges as much in column 3, lines 17 - 18, which state that "As the person skilled in the art will appreciate pumping of a fluid depends on the rheological properties of said fluid". In other words, a pump that is suitable for a fluid of one viscosity is not necessarily suitable for a fluid of a different viscosity and different rheological properties. For this reason, a person skilled in the art would not find the pump disclosed in Gerstenberg to be pertinent to the pump disclosed in Kabe and could not find any reason to modify Kabe in the manner proposed by the Official Action.

The Official Action states several times (such as on pages 5 and 8) that the pumps of Kabe and Gerstenberg are analogous to each other because they both use screw pumps enclosed in cylindrical casings for forcing a viscous liquid through a pump to move it from one location to another. It is true that both references have a screw pump disposed in a cylindrical casing and that both force a viscous liquid through a pump to move it from one location to another, but these are trivial similarities. Almost every screw pump is enclosed in a cylindrical casing so as to force fluid to travel axially through the pump rather than simply being stirred around, and almost every pump has the

function of moving a fluid from point A to point B. As for the fact that both pumps handle a viscous fluid, this is basically the same as saying that both pumps handle a fluid, since almost any real fluid is a viscous fluid, meaning that it exhibits an internal resistance to flow. See, for example, "The Condensed Chemical Dictionary" (Tenth edition, 1981, page 1089) or "Elements of Physics by Alpheus Smith and John Cooper (McGraw Hill, 1972, p. 172) concerning viscosity. Water is a viscous fluid. Molasses is a viscous fluid. Air is a viscous fluid. Thus, the similarities between Kabe and Gerstenberg pointed out by the Official Action are essentially meaningless to a person skilled in the art, and a person skilled in the art dealing with a wave soldering device like that disclosed in Kabe would have no reason to see any relevance in Gerstenberg based on these minor similarities.

The bottom of page 8 of the Official Action states that "It would not be unreasonable to expect one of ordinary skill in the art at the time the invention was made to look to Gerstenberg to improve the pumping functions of solder tank impellers. More blades means that each blade has to do less work. It naturally follows that the pumping action would be improved". The Official Action does not identify the source of this theory of pump operation, but it is not one that the Applicants have heard of. As stated on page 3 and 4 of the declaration by Professor Charles Garris filed on August 28, 2010 in connection with the present application, increasing the number of vanes of a pump may

increase or decrease efficiency, and for a given working fluid, the optimum number of blades can be determined only by experimentation. As stated on page 4 of the declaration, it is not readily predictable whether the beneficial effects of an increased number of vanes and an increased number of turns on stability and a decrease in pressure fluctuations are outweighed by the beneficial effects of a reduced number of vanes and fewer turns. Therefore, the statement on page 8 of the Official Action that "It naturally follows that the pumping action would be improved" by adding more blades to the pump of Kabe is incorrect.

To summarize, as a person skilled in the could find no reason to combine Kabe and Gerstenberg in the manner proposed by the Official Action, the proposed combination of the references is unreasonable, and as such, the Official Action has failed to set forth a *prima facie* case of obviousness. Claims 9, 11 - 17, and 20 - 27 are therefore allowable. As stated below, claim 28 has been cancelled as redundant, so the rejection of claim 28 is moot.

In support of the allowability of the claims, a declaration under 37 CFR 1.132 showing unexpected effects of a wave soldering tank described by the pending claims is attached to this amendment. The declaration was prepared by Mr. Hirokazu Ichikawa, who is an employee of the assignee of the present application and who performed experiments comparing the performance of a 1-blade screw pump, a 2-blade screw pump, and a

four-blade screw pump. Of particular interest are the experimental results shown in the graphs labelled Exhibit B. In an experiment described beginning in the last paragraph of page 2 of the declaration, a soldering tank equipped with either a 1-blade screw pump or a 4-blade screw pump was operated at different rotational speeds, and the height of a solder wave discharged from a secondary nozzle of the soldering tank was measured with a laser displacement sensor. The rotational speed of the pump was instantaneously increased in increments of 5 Hz. The wave height of the secondary nozzle was measured continuously from before to after a change in rotational speed in order to observe the transient characteristics of the resulting wave. The first page of Exhibit B shows the results for a 1-blade screw pump, and the second page of Exhibit B shows the results for a 4-blade screw pump.

From a comparison of page 1 and page 2 of Exhibit B, it can be seen that at any rotational speed, the 4-blade pump produced a greater wave height than the 1-blade pump, and that when there was a step change in the rotational speed of the pumps, the solder wave stabilized in height far more quickly with the 4-blade pump than with the 1-blade pump. The difference in the length of time required for stabilization increased as the rotational speeds of the pumps increased. The wave height for the 1-blade pump sometimes took as long as 30 seconds to stabilize after a change of 5 Hz in the pump rotational speed, while the wave height for the 4-blade pump stabilized nearly

instantaneously when there was a change in pump rotational speed. As set forth in the declaration by Mr. Ichikawa, the greatly reduced time required for wave stabilization of a 4-blade pump compared to a 1-blade pump is a valuable feature of a 4-blade pump, since it means that more electronic parts can be soldered per minute when soldering is being carried out by a method (described in the declaration) in which the rotational speed of the pump and the resulting wave height is reduced to a minimum level between parts to be soldered.

The graphs shown in Exhibits A and B were previously submitted as part of the above-mentioned declaration under 37 CFR 1.132 by Professor Charles Garris which was filed on August 28, 2010. In that declaration, Professor Garris analyzed the graphs and stated that the results shown in Exhibit B are not predictable, since he did not know of any characteristic of screw pumps which would necessarily result in the phenomenon shown in the graphs.

Concerning the data shown in Exhibit B, page 3 of the Official Action states that the data are insufficient to show unexpected results because, according to the Official Action, "In order to show unexpected results, one must show a particular trend based on the number of blades, and then show that a four-blade pump defies what would normally be expected based on the trend, and instead creates a much improved product that is completely unexpected. Thus, more than two points per graph are

needed to show this trend and the expected results for a four blade pump."

The Official Action is relying on a nonexistent standard as to what constitutes unexpected effects. There is no rule that evidence of unexpected effects must be presented in a specific manner, and there is no *per se* rule that unexpected results can only be shown by comparing a series of data points. Unexpected effects are simply effects which are not predictable from the closest prior art cited by the Official Action, and any way of showing that the effects are not predictable will suffice. The closest prior art relied upon in the Official Action is the Kabe reference, which discloses a screw pump having only a single blade, and that is therefore the only art that it is necessary to make a comparison with in order to show unexpected effects.

As stated in MPEP 716.02(e)(III), "Although evidence of unexpected results must compare the claimed invention with the closest prior art, applicant is not required to compare the claimed invention with subject matter that does not exist in the prior art. *In re Geiger*, 815 F.2d 686, 689, 2 USPQ2d 1276, 1279 (Fed. Cir. 1987)". This same section of the MPEP further cites *In re Chapman*, 357 F.2d, 418, 148 USPQ 711 (CCPA 1966), where requiring the applicant to compare claimed invention with polymer suggested by the combination of references relied upon in the rejection of the claimed invention under 35 U.S.C. 103 "would be requiring comparison of the results of the invention with the

results of the invention".

Since the closest prior art being relied upon in the present application is the wave soldering tank of Kabe, which has a screw pump with only a single blade, the Applicant only need compare a 4-blade screw pump with a 1-blade screw pump in order to show the unexpected effects of a 4-blade screw pump. As set forth above, the declaration by Professor Garris shows that the experimental results shown in Exhibit B of the declaration by Mr. Ichikawa are in fact unexpected. These unexpected results therefore provide further evidence of the nonobviousness of the invention described by claims 9, 11 - 17, 22, and 25, each of which describes a wave soldering tank with a screw-type pump having at least 4 helical blades.

Amended claim 20 is allowable for the reasons given above, i.e., because there is no basis for combining the references in the manner proposed by the Official Action, and it is further allowable in its own right. Amended claim 20 describes a wave soldering tank which includes a bowl-shaped guide having curved surfaces which are curved directly beneath the first and second openings of a partition. Namely, claim 20 not only states that the bowl-shaped guide has curved surfaces but identifies where curvature exits, i.e., directly beneath the first and second openings. Amended claim 20 is supported by Figure 5 of the drawings as filed, which shows curved surfaces 26 and 27 which are curved immediately beneath an inlet 3 and a through hole 7 in

a partition 6. Claim 20 has also been amended to delete the redundant language "having a multiple-blade screw-type pump" which was pointed out in the Official Action. The cited references do not disclose or suggest such an arrangement. The Official Action describe the bottom surface of the solder tank body 3 of the solder tank 2 of Kabe as having first and second curved surfaces, with each curved surface comprising the completely flat bottom plate 5 of solder the tank body 3, the completely flat side plate 13 or 14 of the solder tank 3, and a corner where the bottom plate 5 and the side plate 13 or 14 are welded to each other. The only portions of these "curved surfaces" which are possibly curved are weld fillets which possibly exist in the corners between the bottom plate 5 and the side plate 13 or 14, and if these weld fillets are in fact curved, they not curved directly beneath any of the openings in the plate 6 in Figure 1 of Kabe dividing the interior of the solder tank 2 into an upper and lower portion because they are not positioned directly beneath the openings. Therefore, the "curved surfaces" of Kabe referred to in the Official Action do not correspond to the curved surfaces set forth in amended claim 20. Therefore, even if Kabe and Gerstenberg were combined in the manner proposed by the Official Action, the combined references would not result in an arrangement having all the features set forth in amended claim 20. Claim 20 and claims 21 - 24, 26, and 27 which depend from it are therefore allowable. Of these claims, claim 26 has been slightly amended to describe the curved surfaces of claim 20 in a manner consistent with the description

of those surfaces in claim 20. Amended claim 26 is supported by Figure 5 of the drawings. The features of claim 28 have been incorporated into amended claim 20, so claim 28 has been cancelled as redundant.

Claim 24, which depends ultimately from claim 20, previously stated that in the wave soldering tank of claim 20, there were no obstructions to flow of fluid between the pump and the interior of the nozzle of the tank. Similarly, claim 25 described a wave soldering tank in which there was an unobstructed flow path between a casing and the interior of a nozzle. Page 7 of the Official Action states that these claims do not distinguish the present invention from Kabe because, according to the Official Action, there are no obstructions to flow of fluid between the pump and the interior of the nozzle in Kabe, despite the fact that in Kabe, molten solder must pass through a flow obstruction in the form of a baffle plate 50 having a large number of small holes 50a formed therein in order to enter a nozzle 18. According to page 9 of the Official Action, the baffle plate 50 of Kabe is not an obstruction because fluid can pass through it. The definition of "obstruction" and "unobstructed" employed in the Official Action is at odds with ordinary English usage. A flow path does not have to be completely blocked off in order to have an obstruction. For example, the terms "partial airway obstruction" and "complete airway obstruction" are commonly used in the medical field to refer to a partial or total blockage of a person's airway to the lungs. If an obstruction were only

something that completely closed off a passage, the term "partial airway obstruction" would be a contradiction, and the term "complete airway obstruction" would be redundant. There are also numerous U.S. patents which use the term "partial obstruction" in their claims, such as U.S. Patent No. 7,677,051 and No. 7,869,058, to give two random examples, which shows that an obstruction does not require complete blockage of a pathway. Therefore, it is incorrect to state that Kabe discloses an unobstructed flow path in light of the presence of the baffle plate 50. In fact, the very purpose of the baffle plate 50 is to provide an obstruction to flow and thereby reduce fluctuations in fluid pressure.

Page 9 of the Official Action states that if the Applicant wishes to claim the absence of a baffle, the Applicant should claim precisely that. Therefore, in order to expedite prosecution, claims 24 and 25 have been amended to state that there is no flow straightening plate between the pump and the interior of the nozzle of claim 24 or between the casing and the interior of the nozzle of claim 25. Amended claims 24 and 25 are supported by page 10 of the specification as filed, which states that a wave soldering tank according to the present invention renders flow straightening plates unnecessary. As the baffle plate 50 employed in Kabe is a form of flow straightening plate, even if Kabe were combined with Gerstenberg in the manner proposed by the Official Action, the combined references would not result in an arrangement having all the features set forth in

claims 24 and 25. These claims are thus allowable.

New claim 29 describes additional features of the present invention and is allowable as depending from claim 20.

In light of the foregoing remarks, it is believed that the present application is in condition for allowance. Favorable consideration is respectfully requested.

Respectfully submitted,

Michael Tobias

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Attachment
Declaration under 37 CFR 1.132 by Hirokazu Ichikawa

Certificate of Transmission

I hereby certify that this correspondence is being facsimile transmitted to the Patent and Trademark Office
on February 22, 2011
(Date of Transmission)

Signature Michael Tobias
Michael Tobias

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:
TAKAGUCHI et al
Application No.: 10/573,449 Art Unit: 1793
Filing date: January 19, 2007 Examiner: Megha Mehta
For: WAVE SOLDERING TANK

DECLARATION UNDER 37 CFR 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Hirokazu Ichikawa, declare as follows:

I am currently the head of the FA Manufacturing Department at the Technical Center of Senju Metal Industry Co., Ltd. (Senju Metal) in Tokyo, Japan. I have been employed by Senju Metal, which is the assignee of this application, since 1990. My primary work is the design and development of automatic soldering equipment.

In 2005, I performed a number of experiments to compare the performance of different screw pumps in a wave soldering tank. The experiments were performed at the Technical Center in Tokyo.

The experiments were performed using a Model EWD-30 wave soldering tank manufactured by Senju Metal Industry Co., Ltd. The soldering tank contained 400 kg of a Sn-3Ag-0.5Cu lead-free solder maintained at 25 degrees C. The tank included a primary nozzle and a secondary nozzle which were supplied with molten solder by a screw pump having either a single helical blade, two helical blades, or four helical blades. I will refer to these a 1-blade pump, a 2-blade pump, or a 4-blade pump.

In a first experiment, the pump was operated at different rotational speeds, and the height of the solder wave discharged from the secondary nozzle was measured with a commercially-available laser displacement sensor. At each rotational speed, the solder wave was allowed to stabilize before measurement of the height took place. Therefore, the measured height indicated a steady-state value. Attached Exhibit A shows the height measurements for the 2-blade pump and the 4-blade pump.

Exhibit A shows that at a given rotational speed, the 4-blade pump tended to produce a greater wave height than the 2-blade pump. However, the difference in the wave height diminished towards zero as the rotational speed increased.

A second experiment was similar to the first experiment in that a pump was operated a different rotational speeds, and the height of the solder wave discharged from the secondary nozzle was again measured with a laser displacement sensor. The rotational

speed was changed instantaneously in increments of 5 Hz. However, in the second experiment, the wave height was measured continuously from before to after a change in rotational speed to observe the transient characteristics of the wave. In particular, I was interested in the length of time required for the wave height to stabilize at a new height after a change in rotational speed.

Attached Exhibit B shows the results for a 1-blade pump (page 1) and a 4-blade pump (page 2). Similar to the results shown in Exhibit A, Exhibit B shows that at each rotational speed, the 4-blade pump produced a greater wave height than the 1-blade pump. More importantly, Exhibit B shows that when a step change in pump rotational speed took place, the height of the solder wave stabilized much more rapidly for the 4-blade pump than for the 1-blade pump. The difference in the length of time required for stabilization became increasingly marked as the rotational speeds of the pumps increased.

The significance of this difference is as follows. One method of wave soldering involves repeatedly varying the wave height of solder discharged from the nozzles of a wave soldering tank. When an electronic part such as a printed circuit board is remote from the nozzles, the pump of the wave soldering tank is operated at a low rotational speed, and the wave height of the waves discharged from the nozzles is set to a very low level in order to reduce oxidation of molten solder in the wave soldering tank. When an electronic part to be soldered approaches the nozzles, the pump

rotational speed is abruptly increased, and the wave height is increased to a level suitable for soldering. After the electronic part has passed through the solder waves, the pump rotational speed is decreased again and the wave height is returned to the very low level. Each time the pump rotational speed is increased in a step-wise manner, it takes a certain length of time for the wave height to stabilize at a new level. An electronic part should not be passed through a solder wave when the wave height is greatly fluctuating because the amount of solder which contacts the electronic part will not be predictable. Therefore, it is necessary to slow down the speed of a conveyor for the electronic part until the wave height has stabilized.

The more quickly the wave height can stabilize, the more quickly can the conveyor operate, and the more electronic parts can be passed through a solder wave per minute. Page 1 of Exhibit B shows that in the case of the 1-blade pump, it sometimes took as long as 30 seconds for the wave height to stabilize in response to a 5Hz change in pump rotational speed. In contrast, page 2 of Exhibit B shows that in the case of the 4-blade pump, the wave height stabilized almost immediately. Therefore, the use of 4-blade screw pump in a wave soldering tank can provide a much high throughput of electronic parts than can the use of a 1-blade screw pump.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements

were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted,

Hirokazu Ichikawa

Hirokazu Ichikawa

Tokyo, Japan

Date: Feb. 22. 2011

Attachments
Exhibit A
Exhibit B

Exhibit A

Comparison of 4-blade pump and 2-blade pump

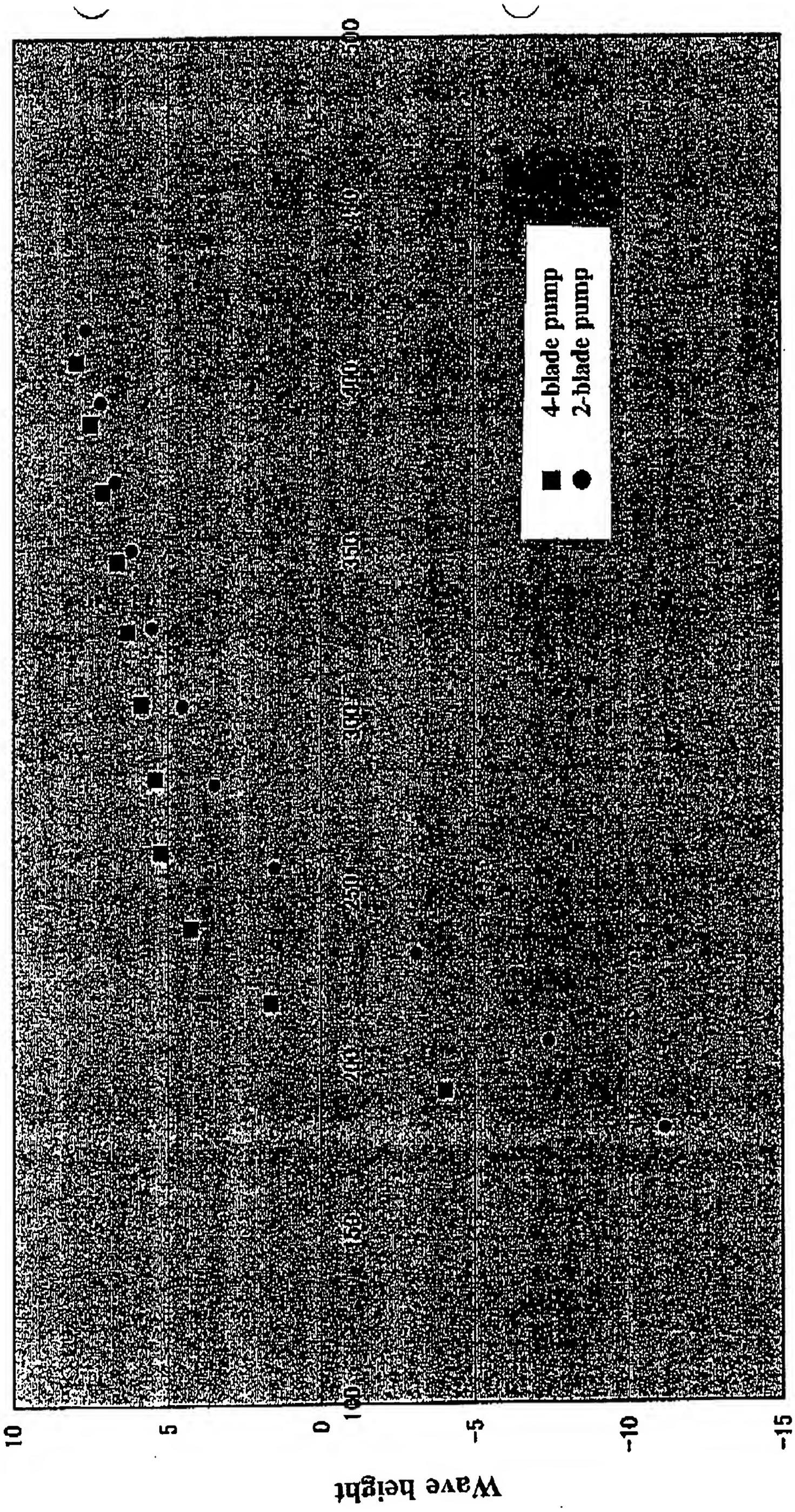

Exhibit B, page 1 1-blade spiral screw

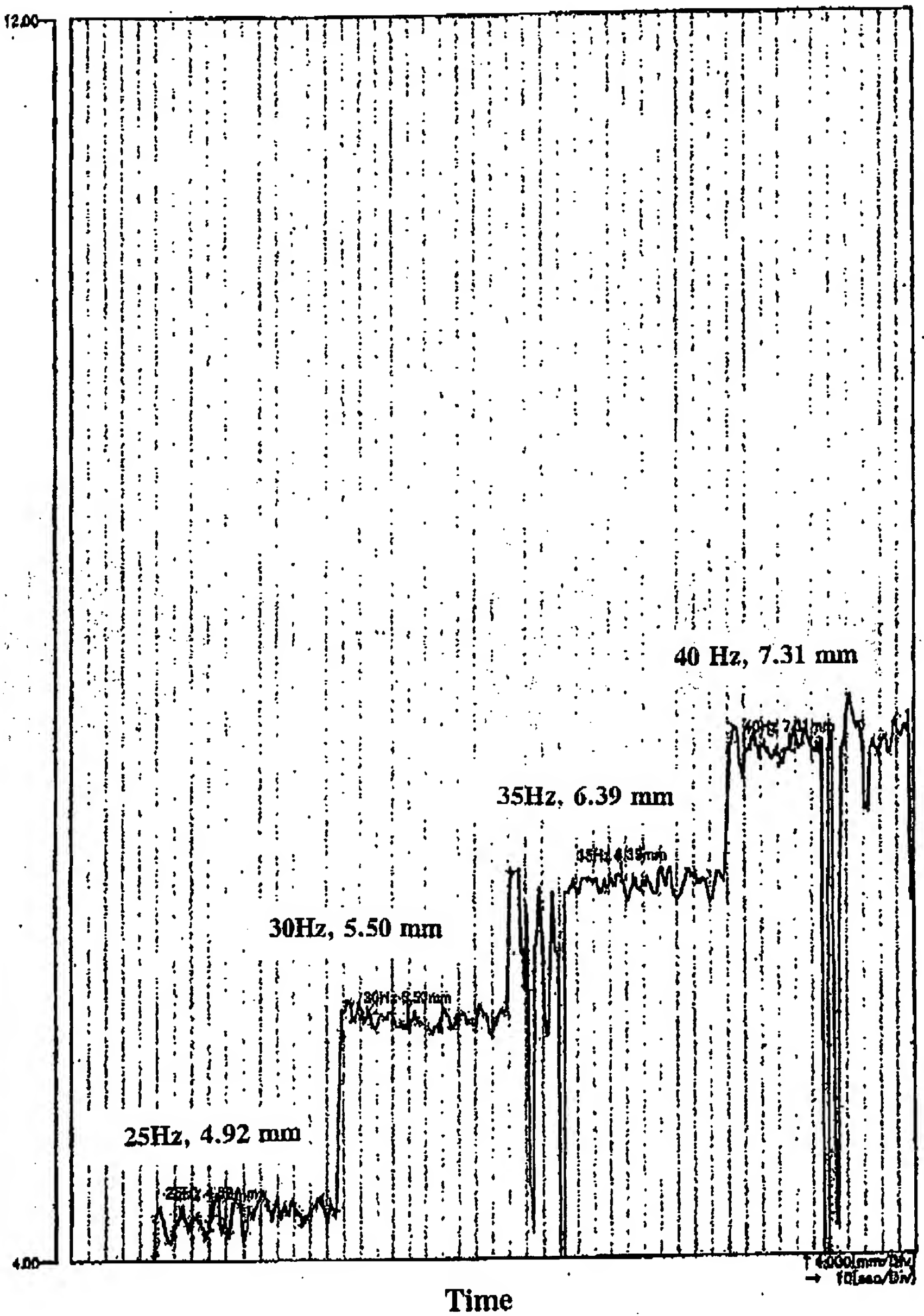

Exhibit B, page 2 4-blade spiral screw